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PATENT SPECIFICATION

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405,833

Complete Accepted: Feb. 15, 1934.

COMPLETE SPECIFICATION.

Improvements relating to the Prevention of the Formation of Carbon Deposits on the Fuel Injection Nozzles of Internal Combustion Engines.

We, AUGUST ANDREAS HEINRICH HAMMER, Engineer of Harland and Wolff Limited, Engineers and Shipbuilders, Queen's Island, Belfast, Danish Subject, and FREDERICK ERNEST REBBECK, Managing Director of Harland and Wolff Limited, aforesaid, British Subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to internal combustion engines of the kind provided with fuel injection devices located in pockets in the cylinder or cylinder head and has for its object to provide improved means for preventing the formation on and adherence of carbon deposits to and around the tip of the fuel injection nozzles during the normal running of the engine. Although applicable to internal combustion engines of all kinds, the invention is particularly applicable to Diesel and similar engines employing oils of low volatility or unrefined crude oil of high volatility, and/or mixtures of oils of different volatility, viscosity or flash point. This invention is also of particular use for oils obtained from distillation of coal which ordinarily causes working and combustion difficulties in internal combustion engines.

It may be explained that previous proposals have been made to provide blast chambers either external to or within the body of the fuel injection devices for directing an air or gas stream towards or across the tip of the fuel injection device after each injection period for the purpose above-mentioned and such chambers when located in the body of the fuel injection device have been charged with air from the cylinder during the compression stroke, to return into the cylinder directly combustion takes place. It has also been proposed to pump water or other fluid into a space at the back of a diaphragm through which the end of the fuel nozzle projects and which cooperates therewith to act as a non-return valve.

According to the present invention, in an internal combustion engine of the kind described, each of the pockets in which the fuel injection devices are located is provided with a blast chamber formed by or between the wall of the pocket and the external walls of a member which surrounds the nozzle of the fuel injection device and the blast chamber is constantly open to the cylinder through one or more outlet orifices, said chambers being supplied with air or gas under pressure during the normal working cycle of the engine, and the air or gas being directed through said outlet orifices towards or across the tip of the nozzle of the fuel injection device after each fuel injection period.

The present invention further consists in utilising the fuel valve pocket in the cylinder as a compression space as well as a cooling chamber for the gases which charge it; said blast chamber being arranged around the nozzle of the fuel injection device.

The outlet orifice for directing the blast of air or gas on to or across the tip of the nozzle may conveniently be an annular space, or any other form of opening or openings suited to the shape of the nozzle tip.

It is known that by utilising the compressed air or mixture in the cylinder for charging the blast chamber, the pressure in the blast chamber can be maintained above that in the cylinder during the expansion and exhaust periods if the orifices are made sufficiently small to prevent a rapid fall of pressure in the chamber, and the blast chamber may be charged through the same orifices.

According to one form of the invention, the chamber may be charged through independent inlet passages closed automatically so soon as the pressure within the blast chamber attains the maximum pressure within the cylinder. When the same orifice or orifices is or are used for both charging and discharging from the blast chamber, the area of the orifices relative to the volume of the blast chamber

[*Price* 1/-]

is determined by well known physical formulæ to ensure that the quantity and velocity of the air or gas blast will meet the requirements for the purposes stated.

The invention is equally applicable to either two-stroke or four-stroke engines either single or double acting, as well as to such engines having a pre-combustion chamber.

In order that the invention may be more clearly understood, reference is hereinafter made to the accompanying drawings illustrating the invention.

Fig. 1 shows diagrammatically one arrangement in accordance with this invention when the blast chamber is charged with air or gas from the cylinders of the engines.

The cylinders G are fitted with automatic outlet valves H which open into pipes K connected to a storage tank L which may be constructed to form a cooler for the air or gas delivered to it from the engine cylinders. Pipes M connect the tank with the blast orifice or orifices arranged around the tips of the nozzles of fuel injection devices E.

Fig. 2 shows in detail the blast chamber F formed between the wall A of the pocket which receives the fuel injection device and a member B surrounding the tip of the nozzle of each fuel injection device E.

Fig. 3 shows diagrammatically another arrangement whereby the blast chamber is charged directly from the engine cylinder. In this case the blast chamber is an annular space N formed between the wall A of the pocket which receives the fuel injection device E and the external walls of an inner conical wall member O which is secured within a liner P in the pocket and surrounds the end of the nozzle R of the fuel injection device E. A disc or flange S which may be integral with the member O closes the lower end of the blast chamber N and has orifices T open on the underside to the engine cylinder and closed above by a disc check valve U movable vertically and guided by the liner P and limited in its movement by an internal collar V on the liner P. Orifices W lead through the disc or flange S from the blast chamber N to the tip of the noozle R. The inlet orifices T are of sufficient area to allow the maximum pressure within the cylinder to be obtained in the blast chamber. The blast orifices W are of restricted area to prevent the pressure in the blast chamber N from falling at the same rapid rate as the pressure in the cylinder during the expansion period. Consequently, when the pressure is decreasing in the engine cylinder, an increasing blast of air or gas will issue through the orifices W and will effectively impinge on the end of the nozzle R.

Fig. 4 shows partly diagrammatically a construction of blast chamber, when the charging and discharging orifice or orifices are common passages.

The fuel injection device E is shown with the tip R^1 of its nozzle R in which a certain amount of fuel oil remains lodged both in the chamber X and in the spray holes Y when the spindle Z is seated after completion of injection. The blast chamber inner wall O surrounds the nozzle R and with the wall A of the pocket which receives the fuel injection device forms a chamber N into which through the orifices W compressed air and gas flows from the engine cylinder during the compression and firing periods, the air and gas in the chamber N being cooled directly by the wall of the water-cooled cover. The pressure in the chamber N will during these periods be less than that in the cylinder itself and the difference is governed by the areas and length of the orifices relative to the volume of the blast chamber. During part of the expansion, exhaust and inlet strokes, the flow of air or gas will be reversed, air or gas issuing from the chamber N through the orifices W.

Fig. 5 shows another form of blast chamber according to this invention in which the inlet and outlet orifices are common.

The blast chamber N in this case is formed between the wall of the pocket (not shown) which receives the fuel injection device E and the external walls of a member which surrounds the fuel injection device, the outer wall of the chamber N being formed by a hollow coupling nut 12 screwed on to the fuel injection device E and the inner wall of the chamber N being formed by members or sleeves 10 and 10a which surround the nozzle R and nozzle tip R_1 of the fuel injection device.

The blast orifices W can be arranged as radial slots either in the end of the sleeve 10 which surrounds the nozzle tip R_1 or in an annular boss formed on the cap 11 of the coupling nut 12. The orifices W may alternatively take the form of a narrow annular space between the parts 10 and 11.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In an internal combustion engine provided with fuel injection devices located in pockets in the cylinder or cylinder head, the provision in each of said pockets of a blast chamber formed

by or between the wall of the pocket and the external walls of a member which surrounds the nozzle of the fuel injection device, the blast chamber being constantly open to the cylinder through one or more outlet orifices, said chamber being supplied with air or gas under pressure during the normal working cycle of the engine, and the air or gas being directed through said outlet orifices towards or across the tip of the nozzle of the fuel injection device after each fuel injection period, for the purpose specified.

2. In an internal combustion engine as claimed in claim 1, means whereby the chamber is charged with air or other gas drawn from the air or mixture within the engine cylinder.

3. An internal combustion engine according to claim 1 or 2 in which the air or gas or gaseous mixture is compressed into the chamber during the compression stroke of the engine through the constantly open orifice or orifices and is automatically released through the same orifice or orifices during the expansion stroke of the engine.

4. A modification of the invention claimed in claim 3 in which an additional orifice or orifices is or are provided in the chamber, each fitted with a check valve allowing air or gas or gaseous mixture to enter the chamber during the compression stroke but closing on the expansion stroke.

5. An internal combustion engine according to any of the preceding claims, in which the chamber takes the form of an annular space surrounding the end of the fuel injection device.

6. An internal combustion engine as claimed in claim 1, in which the chamber communicates with a vessel situated remote from the fuel injection device and combustion chamber but in connection with the engine cylinder by pipes or passages and charged on the compression stroke of the engine, substantially as described with reference to Figs. 1 and 2 of the accompanying drawings.

7. An internal combustion engine according to claims 4 and 5 having the chamber constructed and arranged substantially as herein described with reference to Fig. 3 of the accompanying drawings.

8. An internal combustion engine according to claim 3 having the chamber constructed and arranged substantially as herein described with reference to Fig. 4 or 5 of the accompanying drawings.

Dated this 20th day of May, 1933.

JOHNSONS,
Chartered Patent Agents,
41, St. Vincent Place, Glasgow, and
10, Stafford Street, Edinburgh.

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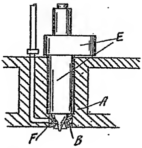
[This Drawing is a reproduction of the Original on a reduced scale.]

FIG. 2



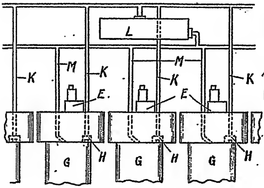


FIG. 1

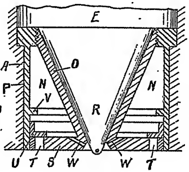
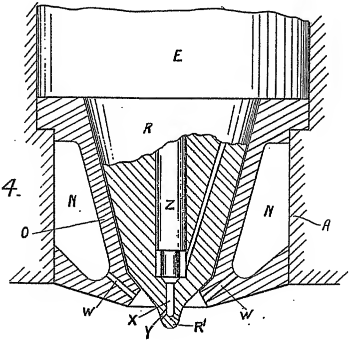
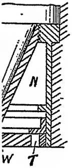


FIG. 3.

FIG. 4.





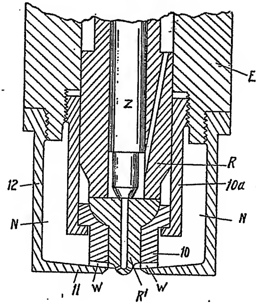
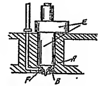


FIG. 5.

Malby & Sons, Photo-Litho.

FIG. 2



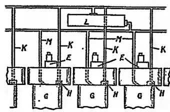


FIG. 1

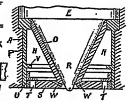
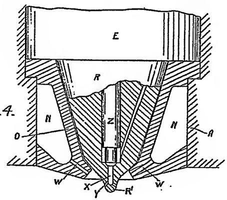


FIG. 3.

FIG. 4.



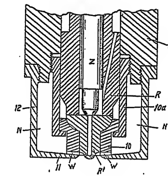


FIG. 5.

[This Drawing is a reproduction of the Original on a reduced scale.]